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9/12/30/96

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MEETING LOG
DIRECTORATE FOR ENGINEERING SCIENCES

SUBJECT: Meeting with the CGA/ANSI Z21 Joint Subcommittee on Refrigerators and Portable Camping Equipment to Present Recommended Changes to the Current Standards Requirements

PLACE: Days Inn, Toronto Airport, Toronto, Canada

MEETING DATE: May 29, 1996

LOG ENTRY SOURCE: Donald W. Switzer DWS

ENTRY DATE: December 18, 1996

COMMISSION ATTENDEES:

Don Switzer

NON-COMMISSION ATTENDEES:

See Attached Minutes

MEETING SUMMARY

Staff made the attached presentation to the Joint Subcommittee to support the attached recommendations to amend the CO emissions and oxygen depletion requirements in the standard. The subcommittee formed a task force consisting of camping heater manufacturers and CPSC staff to develop the required standard revisions. Minutes of the meeting are attached.

Attachments (2)



U.S. CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, D.C. 20207

May 15, 1996

Mr. Bruce McGowen, P.E.
International Approval Services
55 Scarsdale Road
Toronto, Ontario Canada M3B 2R3

Re: Camping Heater Standard Development

Dear Mr. McGowen:

The CPSC staff has identified a number of deficiencies in the combustion section of the ANSI Z21.63 standard. CPSC has undertaken a testing program for camping heaters to gather data to assist in standard development. At this time testing is ongoing. Preliminary results, which have been shared with the manufacturers, clearly show shortcomings in the standard.

The standard is inadequate in its provisions to protect against the hazards associated with carbon monoxide (CO) production. The standard 1) does not take into account exposure time to CO, 2) allows appliance operation at too low an oxygen level, 3) does not require testing the appliance until it extinguishes, 4) does not test at the most stringent air exchange rates and 5) allows warm-up and break-in time prior to testing. A detailed discussion of each shortcoming follows.

The standard is inadequate in that the performance requirements in section 2.7 do not account for CO exposure time. The physiological effects of CO are caused by the production of carboxyhemoglobin (COHb) in the blood which is dependent upon both CO concentration and time. In general, the literature indicate that at COHb levels of 10 percent or less there are no discernable health effects in the average healthy adult. This is a level at which such an individual is still mentally and physically able to take appropriate action to avoid the harmful consequences of carbon monoxide exposure. Staff recommends that the products perform so as to limit COHb to 10 percent or less.

As currently written, ANSI Z21.63 allows a heater to produce 250 ppm CO when tested in an enclosed room and enough fuel has been consumed to reduce the oxygen level to 15.1 percent. The testing is terminated when the oxygen level reaches 15.1 percent. Terminating the testing while the product is still operating is unacceptable. CPSC staff's testing demonstrates that lower levels of oxygen can be obtained when a camping heater is used in

Mr. Bruce McGowen, P.E.

Page 2

an enclosed chamber, and that, under those conditions, very high CO levels can be achieved. The staff recommends that testing continue until the camping heater extinguishes itself.

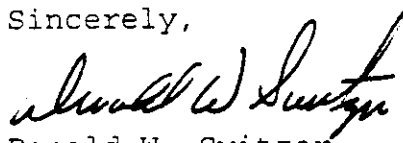
CPSC recommends that the standard be modified to require that the minimum oxygen level that can be achieved in an enclosed chamber be 16 percent. The medical literature indicates that at steady state oxygen levels of 15-16% and above there are no noticeable health effects in healthy individuals.

In Phase I testing each heater was tested over a range of air exchange rates from 0 to 4 air changes per hour. The results indicate that the highest CO levels occur at air exchange rates slightly above zero. Some heaters reached the highest CO concentrations at 0.5 air changes per hour and others at 1.0 air changes per hour. ANSI Z21.63 should be amended to require certification testing at several low air exchange rates to test a range of performance.

The current standard allows a break-in time of 1 hour and a warm-up time of 15 minutes before testing is to begin. This is not representative of actual use where the consumer may start a heater cold and use it immediately.

To address these concerns CPSC staff recommends changes to section 2.7 of the ANSI Z21.63 standard. These recommendations are attached. If you need additional information or have any questions call Don Switzer at (301) 504-0508, ext. 1303 or Jim Bertoch at (301) 504-0494, ext. 1313.

Sincerely,



Donald W. Switzer
Project Manager,
Fire/Gas Codes and Standards
Directorate for Engineering
Sciences

Enclosures

CPSC Staff Recommendations to ANSI Z21.63

2.7 COMBUSTION

The combustion of the heater shall be deemed satisfactory when heaters for use with propane HD-5 only and heaters for use with liquefied petroleum gases are tested when equipped for using propane HD-5 and:

~~a. A concentration of carbon monoxide not in excess of 35 ppm is produced in a room with no air exchanges occurring during combustion of the amount of gas necessary to reduce the oxygen content of the room to a quantity equal to 19.4 percent (1.0 percent carbon dioxide) by volume, corrected to 60 F and 30.0 inches mercury; and~~

a. When operated in an enclosed room of 100 cu. ft. volume with zero air exchange the heater shall not deplete the oxygen level to below 16 percent by volume corrected to 30.0 inches mercury.

Rational: CPSC staff has tested a number of camping heaters currently on the market. This testing took place in an enclosed chamber. When the units were tested at zero air changes per hour high concentrations of CO were produced as the oxygen was depleted below 16%. The heaters did not extinguish themselves until oxygen levels decreased below 14%. This decreased oxygen level can result in significant health effects. The literature generally indicates no noticeable health effects at steady state oxygen levels of 15 - 16% and above in the average healthy adult.

~~b. A concentration of carbon monoxide not in excess of 250 ppm is produced in a room with no air exchanges occurring during combustion of the amount of gas necessary to reduce the oxygen content of the room to a quantity equal to 15.1 percent (3.8 percent carbon dioxide) by volume, corrected to 60 F and 30.0 inches mercury;~~

b. When operated to extinguishment in a room of 100 cu. ft. volume with 0, 0.5 and 1.0 air changes per hour, the total CO exposure shall be such that the carboxyhemoglobin level in a healthy average adult shall not exceed 10 percent when calculated with the following equation;

$$\%COHbt = \%COHb0 \exp[-(t/2398B)] + 218(0.007B + COppm/1403)\{1 - \exp[-(t/2398B)]\}$$

%COHbt = Carboxyhemoglobin at end of period.

%COHb0 = Carboxyhemoglobin at beginning of period.

t = Time period (15 seconds).
 CO_{ppm} = CO concentration at end of time period.
 $B = (1/Dl + 713mm\ Hg/Va)$.
 Va = Alveolar ventilation rate (ml/min) = $0.67Ve$
 Ve = Respiratory minute volume (ml/min).
 Dl = Diffusivity of CO in the lung (ml/min-torr).

Ve	Dl	Va	B
12000	35	8040	0.1173

and when heaters for use with liquefied petroleum gases are tested when equipped for propane HD-5 and using n-butane they shall meet the requirements of "a" and "b" above. and-

Rational: CPSC testing indicate that the heaters produce the highest CO concentrations at air exchange rates greater than zero. The heaters produce the highest CO concentrations below 16% oxygen. At zero air changes per hour the heaters extinguished, while at higher air exchange rates the heaters continued to operate during the highest CO producing portion of the test. Most of the heaters produced the highest CO concentrations between 0 and 1.0 air changes per hour. Some heaters produced the highest CO concentrations at 0.5 air changes per hour while others produced the highest at 1.0 air changes per hour. Multiple air exchange rates of 0, 0.5 and 1.0 are required to test the full performance spectrum of each heater. Because the volume flow rate of air to the heater is dependent on the air exchange rate and the volume of the room a uniform room size must be established. A 100 cu. ft. room represents the approximate volume of a small tent or camper top.

As the carboxyhemoglobin (COHb) is a function of both time and CO concentration, both factors should be used in determining the performance requirements. The proposed Coburn-Forster-Kane-based equation is used to calculate the COHb as a function of time and CO concentration. The literature generally indicates no noticeable health effects at COHb levels below 10% in the average healthy adult. For the camping heater standard to be reasonably protective, the input values for B should be based on standard reference values for a moderately active adult (i.e. respiratory minute volume of 12,000 ml/min).

~~e. A concentration of carbon monoxide not in excess of 35 ppm is produced in a room with no air exchanges occurring during combustion of the amount of gas necessary to reduce the oxygen content of the room to a quantity equal to 19.4 percent (1.0 percent carbon dioxide) by volume, corrected to 60 F and 30.0 inches mercury.~~

Method of Test

~~The heater shall have been operated at normal input for at least 1 hour before being subjected to the following tests.~~

The heater shall not be warmed up prior to being subjected to the following tests.

Rational: Heaters may not be warmed up prior to use in the field.

Heaters for use with propane HD-5 only and heaters for use with liquefied petroleum gases shall be tested when equipped for and using propane HD-5 to determine compliance with the oxygen limits specified in "a" and the carbon monoxide limits specified in "a" and "b" above when (1) tested at increased inlet test pressure or, if a pressure regulator device is provided, at the maximum input rating in the range of reduced through increased inlet test pressure (see 2.6.1) and when (2) tested at reduced inlet test pressure or, if a pressure regulation device is provided, at the minimum input rating in the range of reduced through increased inlet pressure.

Heaters for use with liquefied petroleum gases shall also be tested when equipped for propane HD-5 and using n-butane to determine compliance with the oxygen limits specified in "a" and the carbon monoxide limit specified in "b" ~~"c"~~ above when (1) tested at the increased inlet test pressure or, if a pressure regulation device is provided, at the maximum input rating in the range of reduced through increased inlet test pressure (see 2.6.1) and when (2) tested at normal inlet pressure.

For all test conditions, tests are to be conducted on both the heater incorporating the maximum system conditions and the heater incorporating the minimum system conditions.

Heaters equipped with a valve intended for variable heat control shall have tests conducted for all test conditions on a heater incorporating the minimum system conditions and adjusted for the nominal low input setting.

For each test the heater shall be tested in a 100 cu. ft. ~~an adequately size~~ room constructed so as to control the air exchange from 0 to at least 1.5 air changes per hour with an accuracy of 0.1 air changes per hour. The test room shall be designed to maintain a room temperature of 70 F. ~~prevent infiltration of air. The heater shall be operated outside the room for 15 minutes at increased inlet test pressure. Immediately after the heating up period, the heater shall be placed in the room and continued in operation with the door~~

~~sealed.~~ The test room shall be adjusted to establish the air exchange rate for the specific test. The heater shall then be ignited in the room and the room sealed to start the test.

A sample of the room atmosphere shall be withdrawn at the start of the test and analyzed for carbon monoxide, ~~and~~ oxygen ~~or~~ and carbon dioxide. During the test, ~~sufficient~~ samples shall be withdrawn and analyzed for oxygen ~~or~~, carbon dioxide and carbon monoxide every 15 seconds to permit accurate determination of the carboxyhemoglobin levels as specified in "a" and "b" above. ~~end point of the tests specified.~~

A sample of the room atmosphere shall be withdrawn when the oxygen concentration in the room reaches 19.4 percent (1.0 percent carbon dioxide) by volume corrected to 60 F and 30.0 inches mercury. This sample shall be analyzed for carbon monoxide ~~which shall not exceed a 35 ppm concentration.~~

The test shall continue until the heater extinguishes or the CO concentration reaches equilibrium. ~~an oxygen concentration of 15.1 percent (3.8 percent carbon dioxide) by volume corrected to 60 F and 30.0 inches mercury is attained, at which time the test shall be discontinued. A sample withdrawn at the end of the test shall be analyzed for carbon monoxide which shall not exceed a 250 ppm concentration.~~



INTERNATIONAL APPROVAL SERVICES

A JOINT VENTURE OF THE CANADIAN GAS ASSOCIATION AND THE AMERICAN GAS ASSOCIATION

28 August, 1996

To Attendees of: 29-30 May, 1996 Meeting of CGA/ANSI Z21 Joint Subcommittee
on Gas Refrigerators and Portable Camping Equipment

Re: Minutes of the 29-30 May, 1996 Meeting of the CGA/ANSI Joint Subcommittee on Gas
Refrigerators and Portable Camping Equipment

Dear Member & Interested Party:

The first draft of the minutes of the 29-30 May, 1996 Meeting of the CGA/ANSI Z21 Joint Subcommittee on Gas Refrigerators and Portable Camping Equipment have been completed. As the author of the draft minutes was not present at the fore mentioned minutes, it is encourage that any revisions or additions to the minutes be submitted to the undersigned.

A copy of the draft minutes is enclosed.

Yours truly,
IAS Canada

Shelley Van Sickle
Standards Engineer

Acting Secretary to CGA/ANSI Joint Subcommittee on Refrigerators and Portable Camping
Equipment

Enclosed



INTERNATIONAL APPROVAL SERVICES

A JOINT VENTURE OF THE CANADIAN GAS ASSOCIATION AND THE AMERICAN GAS ASSOCIATION

DATE: **Meeting:** 29-30 May, 1996
 Issuance: 26 August, 1996
 Mailing: 28 August, 1996
 (30 days from mailing date)

TO: **Joint Subcommittee Members ONLY**
 (Present and Absent)

RE: **CGA/ANSI Z21 Joint Subcommittee on Gas**
 Refrigerators and Portable Camping
 Equipment

The attached Minutes are for
your APPROVAL prior to
distribution.

We will assume approval if we do
not hear from you, in writing, within
30 days of the above date.

Thank you for your consideration.

MINUTES
OF THE 29-30 May, 1996 MEETING OF THE
CGA/Z21 JOINT SUBCOMMITTEE ON GAS REFRIGERATORS
AND PORTABLE CAMPING EQUIPMENT

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ACTION SUMMARY

ITEM	TASK	RESPONSIBILITY
4	Update Joint Subcommittee Membership	Staff
6	Complete draft requirements for Alternate Tag Materials by August 1, 1996	R. Hoekstra
13	Consider the use of metric threads	Camping Task Group
18	Complete and review draft of Refrigerator Standard by August 1, 1996	Refrigerator Task Group
18	Complete and review draft of heater standard by December 1, 1996	Camping Equipment Task Group
18	Complete and review draft of light & stove standard by February 1, 1997	Camping Equipment Task Group
18	Complete and review draft of catalytic heater standard by April 1, 1997	Camping Equipment Task Group

**MINUTES OF MEETING
OF THE
CGA/ANSI Z21 JOINT SUBCOMMITTEE
ON
GAS REFRIGERATORS AND PORTABLE CAMPING EQUIPMENT**

**Held at the
DAYS INN TORONTO AIRPORT
6257 Airport Road
Mississauga, Ontario**

A meeting of the CGA/ANSI Z21 Joint Subcommittee on Gas Refrigerators and Portable Camping Equipment was held in Toronto, Ontario on May 29-30, 1996 with the following in attendance:

ATTENDEES

Bill Young (Chairman)
Alan Abele
Don Beck
Mike Hamilton
Ralph Hoekstra
Greg Love
Ted Kesik
Susan McCarthy
Pat McConnell
Henry NG
Don Perkins
Frank Schmidt
Ken Sharer
Ted Squires
Bill Sumner
Don Switzer
Rex Weigand
Richard Willey
Bruce McCowan (Secretary)

AFFILIATION

PSI
Mr. Heater
MCCR Ontario
Danby Products Ltd.
Century Tool & Mfg.
Keanall Ind.
Knowledge Mapping Inc.
IAS U.S.
Dometic
IAS Canada
Norcold
Coleman Co. Inc.
Fiesta BBQ
The Squires Co.
Mountain Safety Research
CPSC
Coleman Co. Inc.
DESA International
IAS Canada

**Minutes of Meeting of CGA/ANSI Z21 Joint Subcommittee on
Refrigerators and Portable Camping Equipment
29-30 May, 1996**

ITEM 1 & 2 Call to Order, Introductions and Chairman's Opening Remarks

The Chairman called the meeting to order at 9:00 am and asked that all present introduce themselves.

ITEM 3 Adjustments to Order of Agenda and Call for New Items of Business

There were no adjustments to the order of the agenda.

ITEM 4 Joint Subcommittee Membership Review

4.1 Mr. Ted Squires volunteered to act as Vice-Chair of the Subcommittee if appointed by Mr. Jim Jones.

4.2 Members of the Subcommittee were asked to review the new membership list and for accuracy.

4.3 The Subcommittee was informed that membership will be expiring for a number of members on June 30, 1997. As well, members appointed in May 1996 will expire June 30, 1999.

4.4 The Subcommittee was informed that a full membership review will be performed again in February 1997, in particular membership from "Non-Producer" sectors is required.

4.5 The Chairman accepted the recommendations made by staff in the agenda package (Remove C. Wasserman, D. Dalton, D. Kueterman, G. Huxley, B. McCowan from membership, add H. Ng and Z. Fraczkowski (alternate to D. Beck) to membership, retain D. Stainrod as voting member for PGAC).

4.6 Staff reviewed more proposed membership revisions which are first subject to receipt of additional information.

4.7 The Chairman outlined the arguments contained in his 26 May letter. On this basis, he accepted the recommendations made by staff in the agenda package (Add A. Abele, R. Willey, D. Perkins and G. Love as voting members).

4.8 Staff informed the subcommittee of the resignation of R. Sagulin which took place several meetings ago but apparently had not appeared in the minutes.

It was noted that staff will continue to encourage ICG Propane, the Consumers Association of Canada and other non-producers to participate on the Committee and Task Groups.

**Minutes of Meeting of CGA/ANSI Z21 Joint Subcommittee on
Refrigerators and Portable Camping Equipment
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ITEM 5 Approval of Minutes of Last Meeting

It was moved and duly seconded to adopt the minutes of the last meeting.

- Carried -

ITEM 6 Business Arising from the Minutes of the Last Meeting

Please see minutes of 18 July, 1995 meeting for discussion surrounding motions.

6.1 Ratification of motions and agreements made at last meeting

6.1.1 It was moved and duly seconded to adopt the minutes of the 29 September, 1994 meeting.

- Carried -

6.1.2 It was moved and duly seconded to approve the following motions made at the last meeting of the Subcommittee:

Symptoms of CO exposure shall be included in the instructions of unvented refrigerators in the harmonized standard only; and
Symptoms of CO exposure shall be included in the instructions of portable camping equipment (heating, lighting, cooking) in the harmonized standard only.

- Carried -

6.1.3 It was moved and duly seconded to accept the agreement that the Harmonized Standards will include such duplication of Warning Markings in the Instructions.

- Carried -

6.1.4 It was moved and duly seconded to accept, for the purposes of the Harmonized Standard, the clause proposed by D. Beck in the agenda material subject to changing "AL29-4C" to "300 Series".

- Carried -

6.2 Carbon Monoxide Symptom Warnings in Instructions
Mr. Schmidt provided a brief report on this issue.

6.3 French Markings for Refrigerators

It was agreed that the harmonized standards would be developed including the appropriate French markings and instructions to the same extent as in English.

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29-30 May, 1996**

6.4 Indoor Use of Portable Gas Camp Lights

It was agreed that this issue would be addressed during the harmonization exercises. It was noted that the CPSC was focusing only on heaters.

6.5 Alternate Tag Materials

The discussion focused on the use of polyester and tyvek as alternate tag materials. Mr. Hoekstra agreed that he would complete draft requirements for the harmonized standards by August 1.

6.6 & 6.7 B149 Revisions Relating to Unvented Refrigerators, Additional Requirements for Unvented Refrigerators

P. McConnell explained to the Subcommittee that they are still working on some testing that could be used in the proposed "Detailed Paper". Based on some of the results already received, it was likely that there would be recommendations to change numbers.

6.8 CPSC Report on Carboxyhemoglobin (COHb) Levels for Various Exposure Durations

Mr. Don Switzer of the Consumer Products Safety Commission gave a presentation on CO poisoning incidents involving camping heaters. (See Appendix for overheads). Mr. Switzer stated that although effective labelling of camping heaters and education on the dangers of camping heaters are very important, the most effective solution of this problem would be to design the problems out of the product.

Mr. Switzer summarized the CPSC's concerns to the deficiencies in the current ANSI Standard. The current requirement is based on CO concentration only. To ensure accuracy, it should be based on COHb.

ITEM 7 CPSC Correspondence re: Heater Combustion Testing and Proposed Combustion Performance Requirements

The Subcommittee reviewed correspondence from the CPSC regarding heater combustion testing. Within the correspondence were CPSC proposals for combustion performance requirements.

7.1 Related Information

The Subcommittee reviewed a report dated 76/2/3 on "Tests of Oxygen Depletion Devices on Portable Camping Equipment". The report found that the subject units were able to shut off equipment effectively at oxygen levels between 18.6 and 19.45%. It was noted that both Europe and Australia require ODS systems on unvented portable units. It is possible that North America is the only jurisdiction that still allows camping equipment without ODS devices.

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ITEM 8 Public Awareness/Education Initiative in Relation to Carbon Monoxide Exposure and the Use of Camp Heaters

A report was given to the Subcommittee on steps taken by the Coalition for Propane Camping Heater Safety. The objective of this group is to promote safe use of these products to reduce annual incidents of misuse. The Coalition will primarily be working with an advertising agency to build a strong educational program aimed at the risk group usually involved in these types of incidents. The coalition will be meeting next on June 4 in Chicago. The Subcommittee asked that the coalition add the issues outlined in agenda item 8 to the agenda for the June 4 meeting.

ITEM 9 Tip Test for Portable Camp Heaters

The Subcommittee reviewed the information provided on the proposed tip test for portable camp heaters. It was moved and duly seconded to incorporate the wording from Draft IR 63 into the Draft Harmonized Standard for Camp Heaters.

- Carried -

ITEM 10 CGA Lab Interpretation Notice 94-002 "Additional Requirements for Outdoor Portable Fish Cookers and Table Top Barbecues and Other Matters of Interpretation

It was agreed that the harmonization task group would review the interpretation notice for the purposes of the harmonized standard. If any deletions are proposed, rationale will be provided.

It was moved and duly seconded to: a) turn fish cookers, table tops, and smoker issues herein over to the outdoor gas grill subcommittee so that they do not fall within the scope of the camping equipment joint subcommittee and b) turn the balance of the interpretation notice over to the task group of this joint subcommittee for consideration for the harmonized standard.

- Carried -

It was moved and duly seconded to use interpretation notice 94-2 as a guideline document for portable camp stoves and back pack stoves with a July 1, 1998 effective date.

- Carried -

**Minutes of Meeting of CGA/ANSI Z21 Joint Subcommittee on
Refrigerators and Portable Camping Equipment
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ITEM 11 CGA Certification Requirement 96-002: "Sportsman Hut Heaters of the Vented Type"

This item was considered information for the Subcommittee. It was suggested that the Subcommittee, if sufficient interest existed, could request that the Parent Committees assign this appliance type to the Subcommittee. After much discussion over the applicability of this product type to this Subcommittee, it was moved and duly seconded that CR96-002 is not a complete document and that since it is a vented product it does not fall within the scope of this Joint Subcommittee.

- Carried -

ITEM 12 Alternative to Manual Shutoff Valve Function (Common Agenda Item)

After some discussion, it was moved and duly seconded that this type of valve is not applicable to the standards under this Joint Subcommittee.

- Carried -

ITEM 13 Portable Camp Cook Stoves: Metric Threads

After some discussion, it was moved and duly seconded to forward this discussion to the Camping Task Group for consideration for the harmonized standard.

- Carried -

ITEM 14 Performance at High Altitude

Mr. Bill Sumner of Mountain Safety Research discussed with the Joint Subcommittee, the performance of camping stoves at high altitude based on research performed. Based on a recommendation from Mr. Sumner, it was moved and duly seconded that the harmonization task group would include performance coverage simulating high altitude in the harmonized standards.

- Carried -

ITEM 15 Outdoor Use Requirements

Staff informed the Subcommittee that the CGA Steering Committee "Guidelines for Addressing Common Harmonization Issues in Bi-national CGA/ANSI Standards" requires that at least clauses 2.3.2, 2.3.3, and 2.3.4 shall be included in the appliance standards. It was moved and duly seconded that the outdoor standard is not applicable to outdoor portable equipment.

- Carried -

**Minutes of Meeting of CGA/ANSI Z21 Joint Subcommittee on
Refrigerators and Portable Camping Equipment
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ITEM 16 Energy Efficiency Requirements

After some discussion, it was moved and duly seconded that currently energy efficiency requirements do not apply to portable outdoor equipment.

- Carried -

The Subcommittee noted that the amount of fuel used in these pieces of equipment is insignificant.

ITEM 17 Review of ISC Goals and Objectives

The Chairman read out a review of the Joint Subcommittee's goals and objectives.

ITEM 18 Status Report on Harmonization of Standards Under the Authority of this Subcommittee

18.1 Report from Refrigerator Task Group

Mr. McConnell reported that a draft is approximately 75% finished. When completed, the draft will be circulated to other Task Group members. It was agreed that the draft could be reviewed by the Task Group by correspondence by August 1996. From this submission Staff will compile a draft standard for Joint Subcommittee ballot. If there are no major concerns with the draft it will be issued for public review and comment.

18.2 Report from Camping Equipment Task Group

The Task Group, consisting of Frank Schmidt, reported that the draft is 40% complete. The task group will complete the heater standard first, followed by lights, camp stoves and catalytic heaters. The Subcommittee established the following dates as deadlines: December 1-heaters, February 1-lights and stove, and April 1-catalytic. Mr. R. Hoekstra and G. Love volunteered to become members of the Task Group.

18.3 Information

Staff read an excerpt of minutes of the September, 1994 meeting.

18.4 Staff's Recommended Re-Direction

Staff proposed a recommended re-direction of the efforts of the Subcommittee to those present. The Subcommittee decided that the Task Groups would continue their work until their deadlines as established during this meeting.

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Refrigerators and Portable Camping Equipment
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ITEM 19 Status Report on Revision to the Existing CGA Standards

After some discussion, it was moved and duly seconded that since these proposed changes have not been processed any further, and since the harmonized standards must be processed as soon as possible, and since staff time is extremely limited, it is recommended that these proposed changes be used as input to the harmonized standards. It is further recommended that revised CGA Standards not be processed.

- Carried -

ITEM 20 Other Business

a) Test Methodology for Carbon Monoxide

After a suggestion from D. Switzer, it was moved and duly seconded to form a task group to propose a test methodology for CO test requirements for heaters.

- Carried -

The Task Group will consist of A. Abele, R. Willey, S. McCarthy, R. May, D. Beck, R. Hoekstra, D. Switzer, B. McCowan, and H. Ng with S. McCarthy as the chairperson.

b) Joint Subcommittee Ballots

The Subcommittee agreed that the Joint Subcommittee Ballots on the Draft harmonized standards should be performed one at a time as they are submitted. If any controversial issues arise, a meeting will be called.

ITEM 21 Summary of Action Items for Individuals and Task Groups

The Action Items created during this meeting were summarized.

see page iii

ITEM 22 Next Meeting

It was agreed that a meeting would be held in the first half of 1997 if any controversial issues needed to be resolved. D. Switzer offered to hold the meeting.

ITEM 23 Adjournment

It was moved and duly seconded to adjourn the meeting.

- Carried -

Prepared by: Shelley Van Sickle

Date: June 24, 1996

APPENDICES

96/5/21

Agenda JSC Meeting: May 29-30, 1996

Joint Subcommittee On Gas Refrigerators and Camping Equipment

- 1 Call to Order and Introductions
 - 1.1 Confirmation of Quorum
 - 1.2 Voting regulations
 - 1.3 As appropriate, please indicate on the sign-in sheet that you are staying at this hotel to ensure that credit is given toward the meeting room quota
- 2 Chairman's Opening Remarks
- 3 Adjustments to Order of Agenda and Call for New Items of Business
- 4 Joint Sub-Committee Membership Review
- 5 Approval of Minutes of last meeting (July 18/95) (general distribution will follow)
- 6 Business Arising from the Minutes: **Please bring your agenda material from the last meeting (95/7/18)**
 - 6.1 Ratification of motions and agreements made at last meeting (95/7/18)
 - 6.1.1 Approval of Minutes of Meeting of 94/9/29 (general distribution will follow)
 - 6.1.2 Item 6 (3 Motions re Instructions)
 - 6.1.3 Item 10 (duplication of warning markings in Instructions)
 - 6.1.4 Item 14 (300 Series Stainless)
 - 6.2 Carbon Monoxide Symptom Warnings in Instructions
 - 6.2.1 Report from F. Schmidt on symbols relating to hazardous substances
 - 6.3 French Markings for refrigerators
 - 6.3.1 Report from Staff
 - 6.3.1.1 Markings and instructions in French must be provided under the terms of the Standard if the Standard is to receive acceptance in Canada. The French must be provided to the same extent as the English.
 - 6.4 Indoor use of Portable Gas Camp Lights
 - 6.5 Alternate Tag Materials
 - 6.5.1 Report from R. Hoekstra
 - 6.6 B149 Revisions Relating to Unvented Refrigerators
 - 6.6.1 "Detailed paper" to be prepared by manufacturers (D. Kueterman and P. McConnell): to be endorsed by JSC and parent committees and passed on to Ontario Fuel Safety Branch (ref. 94/9 JSC mtg other business item 12a)

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- 6.7 Additional Requirements for Unvented Refrigerators**
 - 6.7.1 Task Group Report: (D. Kueterman and P. McConnell)**
- 6.8 CPSC Report on Carboxyhemoglobin (COHb) Levels for Various Exposure Durations**
- 7 CPSC correspondence re Heater combustion testing and proposed combustion performance requirements**
 - 7.1 Related Information: Report "Tests of Oxygen Depletion Devices on Portable Camping Equipment" by Canadian Gas Association (76/2/3)**
- 8 Public Awareness / Education Initiative in Relation to Carbon Monoxide Exposure and the Use of Camp Heaters**
- 9 Tip Test for Portable Camp Heaters (Clause 2.9.1)**
- 10 CGA Lab Interpretation Notice 94-002 "Additional Requirements for Portable Outdoor Fish Cookers and Table Top Barbecues and other Matters of Interpretation (Supplementing CAN1-11.2-M79 'Portable Type Gas Camp Stoves')" dated June/95**
- 11 CGA Certification Requirement 96-002: "Sportsman Hut Heaters of the Vented Type"**
- 12 Alternative to Manual Main Shutoff Valve function (Common Agenda Item)**
- 13 Portable Camp Cook Stoves: Metric Threads**
- 14 Performance at High Altitude**
- 15 Outdoor Use Requirements**
- 16 Energy Efficiency Requirements**
- 17 Review of JSC goals and objectives**
- 18 Status Report on Harmonization of Standards Under the Authority of this Subcommittee (Ref. Minutes of 94/9 JSC mtg, pg. 9)**
- 19 Status Report on Revisions to the Existing CGA standards**
- 20 Other Business**
- 21 Summary of Action Items for Individuals and Task Groups (Turnaround time for each)**
- 22 Next Meeting: Location and Date**
- 23 Adjournment**

Meeting 29-30 May, 1996

Joint Subcommittee on Gas
Refrigerators and Camping Equipment

Item 6.8 CPSC Presentation

Estimates of Camping Heater Deaths

YEAR	DEATHS
1992	13
1991	18
1990	13
1989	23
1988	17

- No trend evident
- No injury data available
- Source: National Center for Health Statistics / CPSC

Human Factor Assessment

- **Based on 23 In-depth Investigations**
- **Use patterns**
- **Warning labels**

Regional and Seasonal Use

- **Ages 17-81 Average - 33**
- **Incidents have occurred in almost every region of the country**
- **One incident in July. All others October to May**

Location of Victims Where Specifics Known

• Location	Incidents
– Camper shell	8
– Tent	6
– Van	4
– Trailer	1
– Shed/Ice Fishing Shack	2
– Truck Cab	1
– House Boat	1

Ventilation Where Specifics Known

• Ventilation	Incidents
– Closed	11
– Open	4
– No Windows	4
– Vent Blocked	1
– Unknown	3

Warning Labels Where Specifics Known

- **Labels on heaters**
 - **Yes** 13
 - **No** 2
- **Labeling does not appear effective**

Human Factor Summary

Based on the 23 In - Depth Investigations the following conclusions can be reached.

- Many incidents occurred in Vans, Campers, Trailers etc.**
- Some occurred in tents.**
- Poor ventilation is characteristic of the IDI's.**
- Warning labels appear ineffective.**

CO Effects in Average Healthy Adults (% Carboxyhemoglobin)

- **2-10 % Generally no perceptible effect.**
- **>10-20 % Headache, impaired vision.**
- **20-30 % Throbbing headache, nausea, impaired judgment**
- **30-40 % Severe headache, nausea, vomiting, confusion**
- **40-50 % Coma, convulsions, possible death**

Appropriate COHb Level

- **Based on health effects, an average healthy adult should not exceed 10% COHb**
 - **COHb is a function of CO level and exposure time**

Equation Used In UL 2034

$$\% \text{COHbt} = \% \text{COHb0} \exp[-(t/2398B)] + 218(0.007B + \text{Coppm}/1316)\{1 - \exp[-(t/2398B)]\}$$

%COHbt = Carboxyhemoglobin at end of period.

%COHb0 = Carboxyhemoglobin at beginning of period.

t = Time period in minutes.

COppm /1316 = CO concentration * 760 torr (atmospheric pressure)/1,000,000.

B = (1/DI + 713 mm Hg/Ve).

Ve = Volume of new air entering respiratory passages (ml/min).

DI = Rate of diffusion of CO in the lungs.

DI	Ve	B	Heavy Work
60	30,000	0.0404	

Modified for Camp Heater Standard

$$\% \text{ COHbt} = \% \text{ COHb0} \exp[-(t/2398B)] + 218(0.007B + \text{COppm}/1403)\{1 - \exp[-(t/2398B)]\}$$

%COHbt = Carboxyhemoglobin at end of period.

%COHb0 = Carboxyhemoglobin at beginning of period.

t = Time period (15 seconds).

COppm /1403 = CO concentration * [760 torr - 47 torr]/(atmospheric pressure - water vapor pressure in lungs)/1,000,000.

B = (1/DI + 713 mm Hg/Va).

Va = Volume of new air entering alveoli (ml/min) = 0.67Ve.

Ve = Volume of new air entering respiratory passages (ml/min).

DI = Rate of diffusion of CO in the lungs.

Ve	Va	DI	B
12,000	8,040	35	0.1173

COHb Factors

Work Effort	DI	Ve	Va
1 Sedentary	30	6,000	4,020
2	35	12,000	8,040
3 Light Work	40	18,000	12,060
4	45	24,000	16,080
5 Heavy Work	60	30,000	20,100

Effects of Reduced Oxygen Levels in Air at Sea Level

(20.59% Oxygen in the atmosphere)

- **16-12 % Breathing and pulse increase, slight coordination disturbance**
- **14-10% Emotional upset, abnormal fatigue on exertion, impaired respiration**
- **10-6 % Nausea and vomiting, loss of consciousness, inability to move freely**
- **<6% Convulsion, breathing stops**

Appropriate Oxygen Level

Based on health effects, average healthy adult should not be exposed to oxygen levels below 16% (at sea level).

Interactions

- **Human and animal studies indicate CO exposure effects may be enhanced at high altitude**
- **Human and animal studies indicate CO exposure effects may be enhanced by alcohol**
- **Animal studies indicate CO toxicity may be increased by reduced oxygen**

CPSC Testing

- Test results
- Air exchange test results

Air Exchange Rate Test Procedures

- **Air Exchange Rate Tracked Using Sulfur Hexafluoride**
- **SF6 injected into enclosure**
- **Decay rate tracked using Autotrac**
- **Air exchange rate calculated from decay rate**
 - **$ACH = \ln(\text{Concentration}/\text{Initial Concentration}) / \text{Time}$**

Tent Air Exchange Testing Results

• Small Dome	Rain	12-17 ACH
• Cabin Tent	Rain	7-11 ACH
• Large Dome	Dry Windy	19 ACH
• Large Dome	Snowy	7.5 ACH
• Large Dome	Rain	1.0 ACH
• Large Canvas	Rain	1.7 ACH

Vehicle Air Exchange Testing Results

• Truck Shell	Windy	11 ACH
• Minivan	Cold	1.5 ACH
• Full Size Van	Snow	1.2-1.7 ACH
• Conversion Van	Windy	1.8 ACH

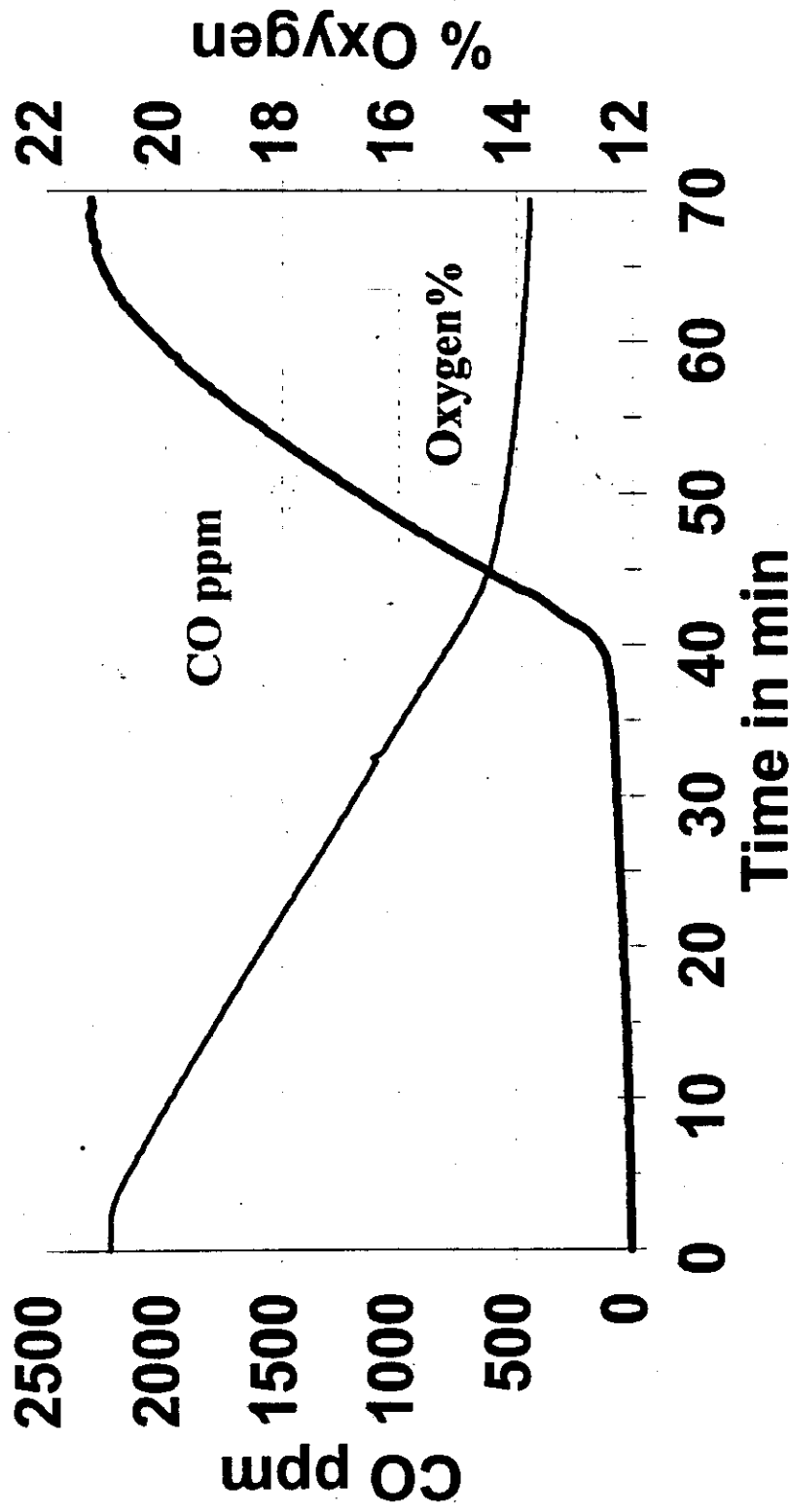
Testing Setup

- **Products recorded**
 - Carbon Monoxide
 - Carbon Dioxide
 - Oxygen
 - Hydrocarbons
 - Temperature
 - Fuel Flow

Testing Setup

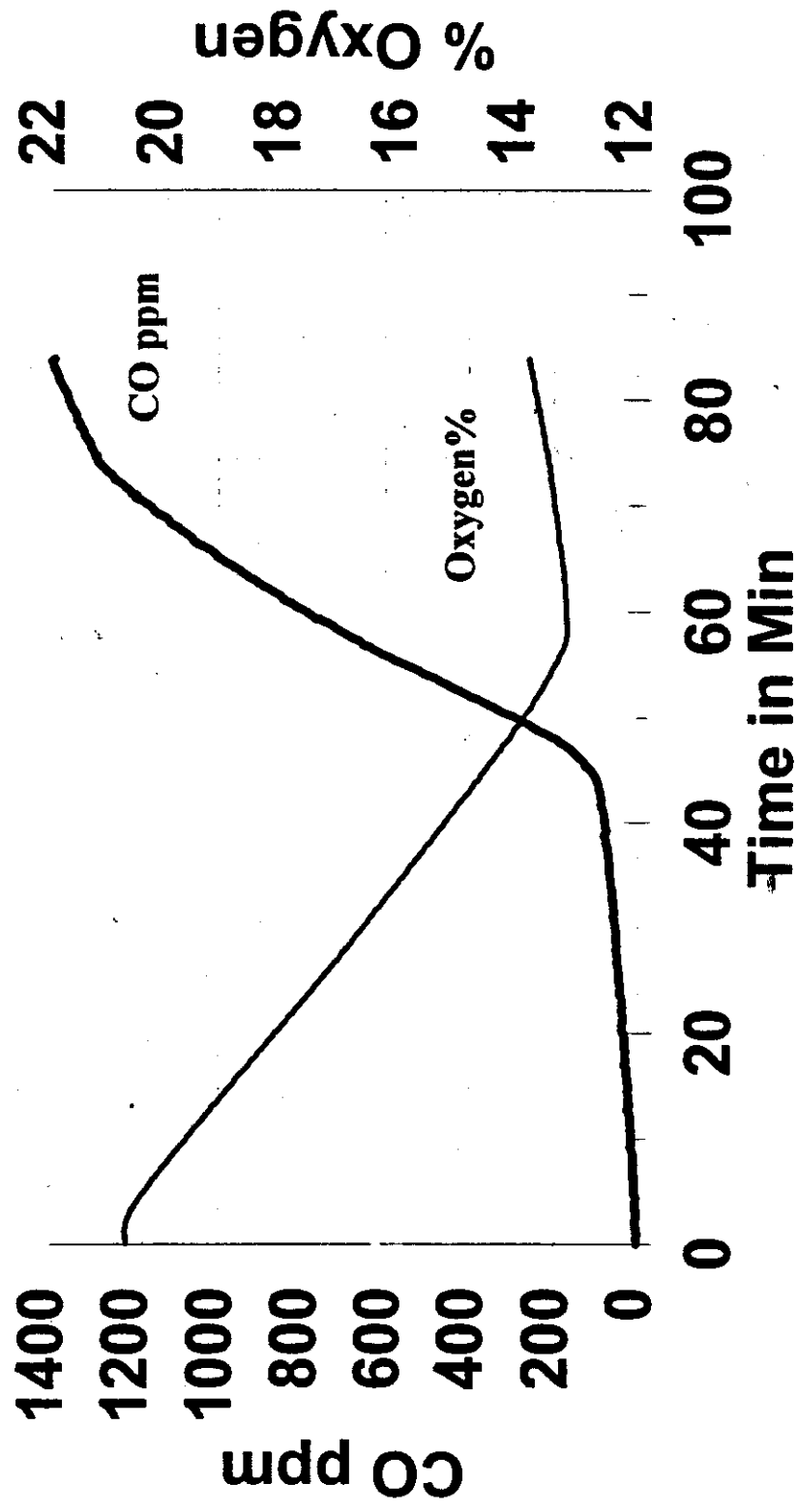
- **Equipment**
 - 100 cu ft chamber
 - Gas analyzers
 - Thermocouples
 - Data collection system

3 - 5,000 BTU; 0 ACH



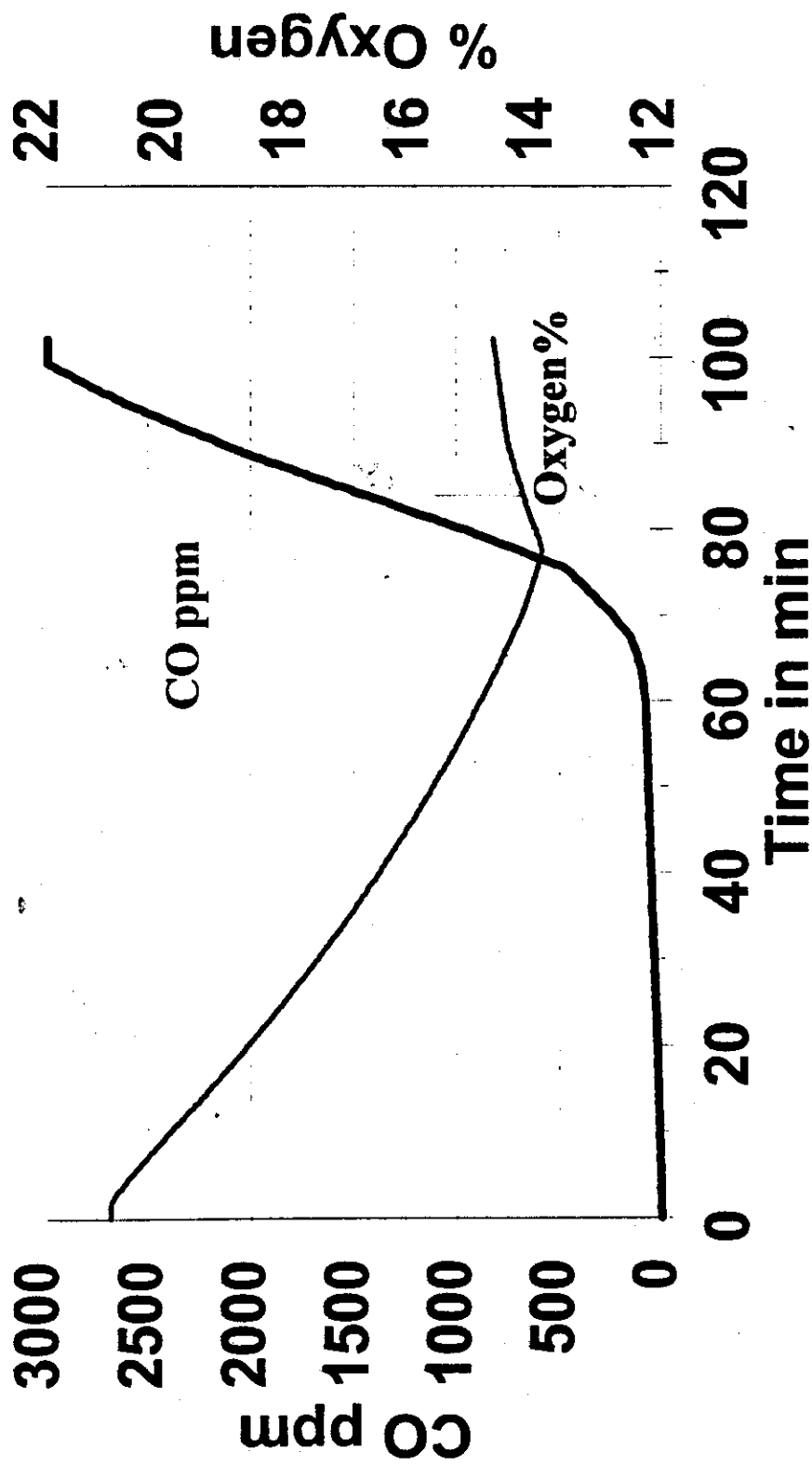
— ppm CO — % O₂

3 - 5,000 BTU; 0.4 ACH



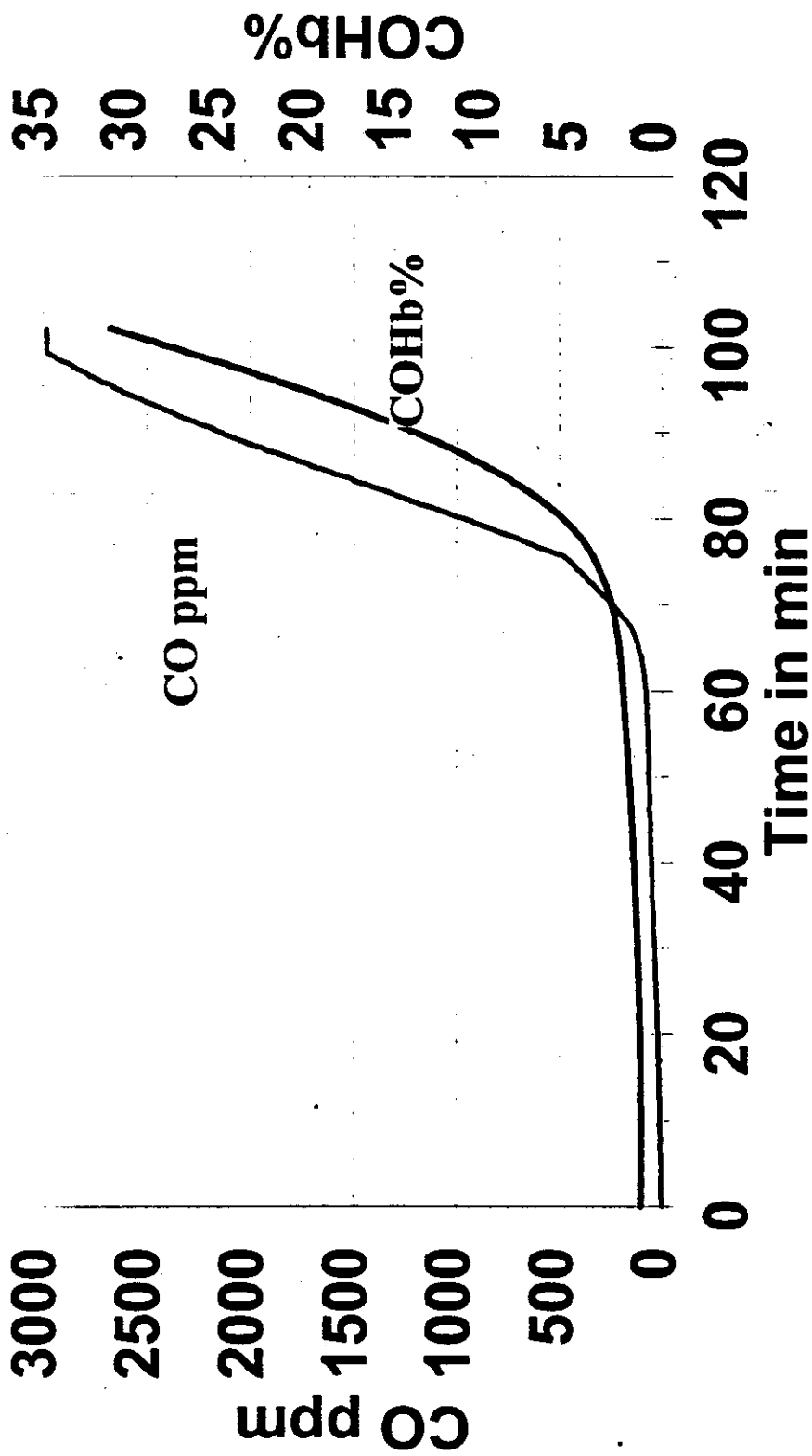
— CO ppm — % Oxygen

3 - 5,000 BTU; 1 ACH



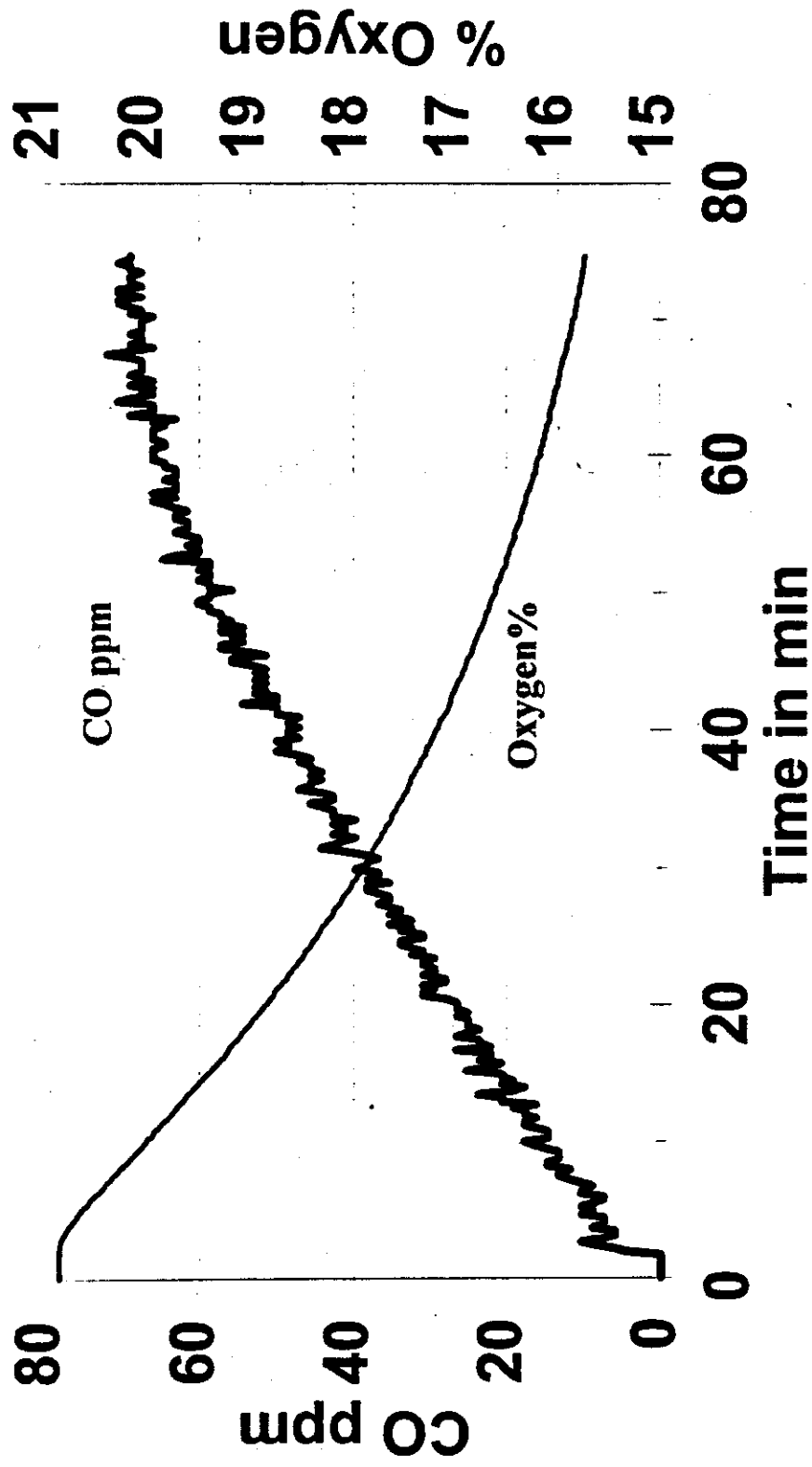
— CO ppm — % Oxygen

3 - 5,000 BTU; 1 ACH



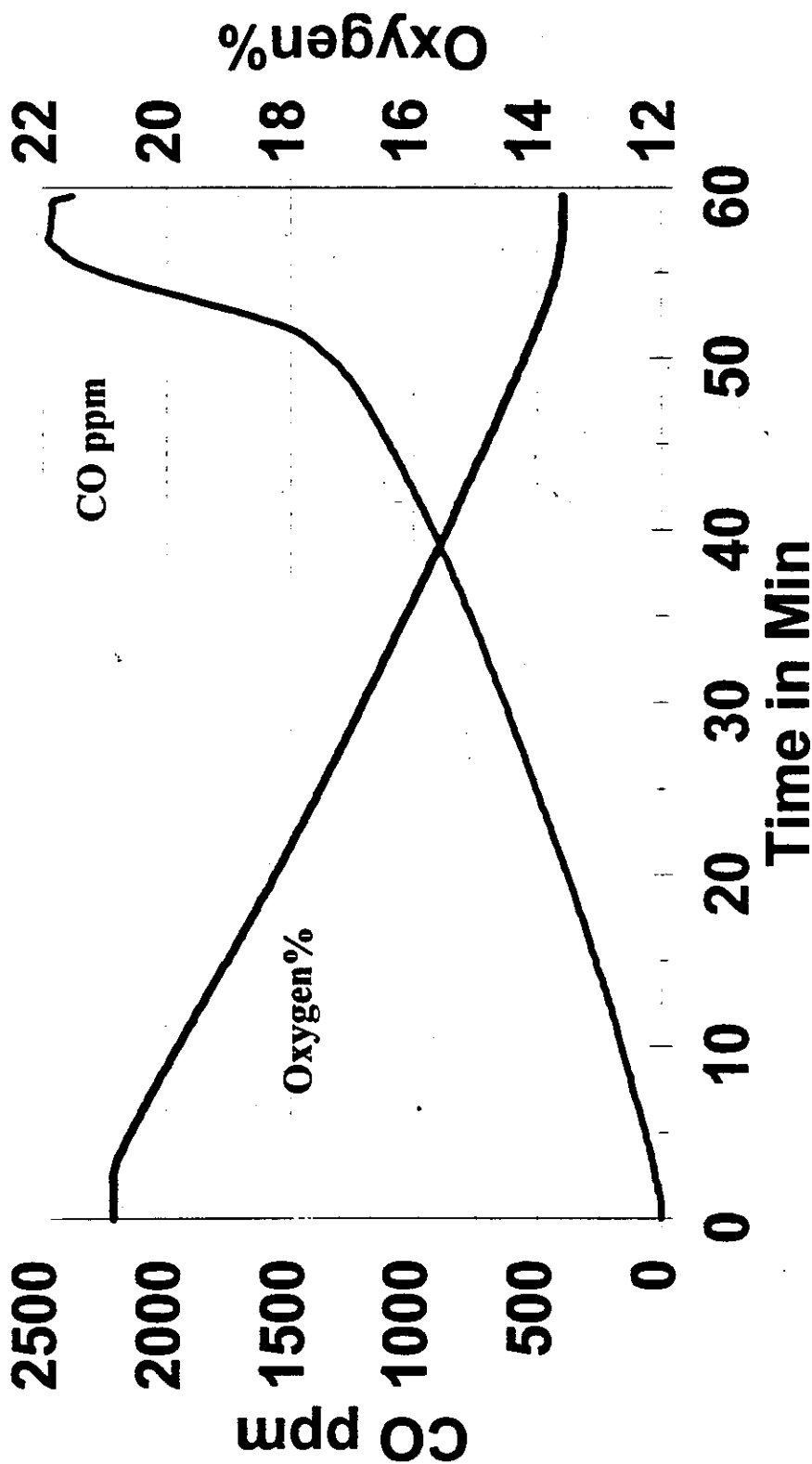
— CO ppm — COHb%

3 - 5,000 BTU; 1.5 ACH



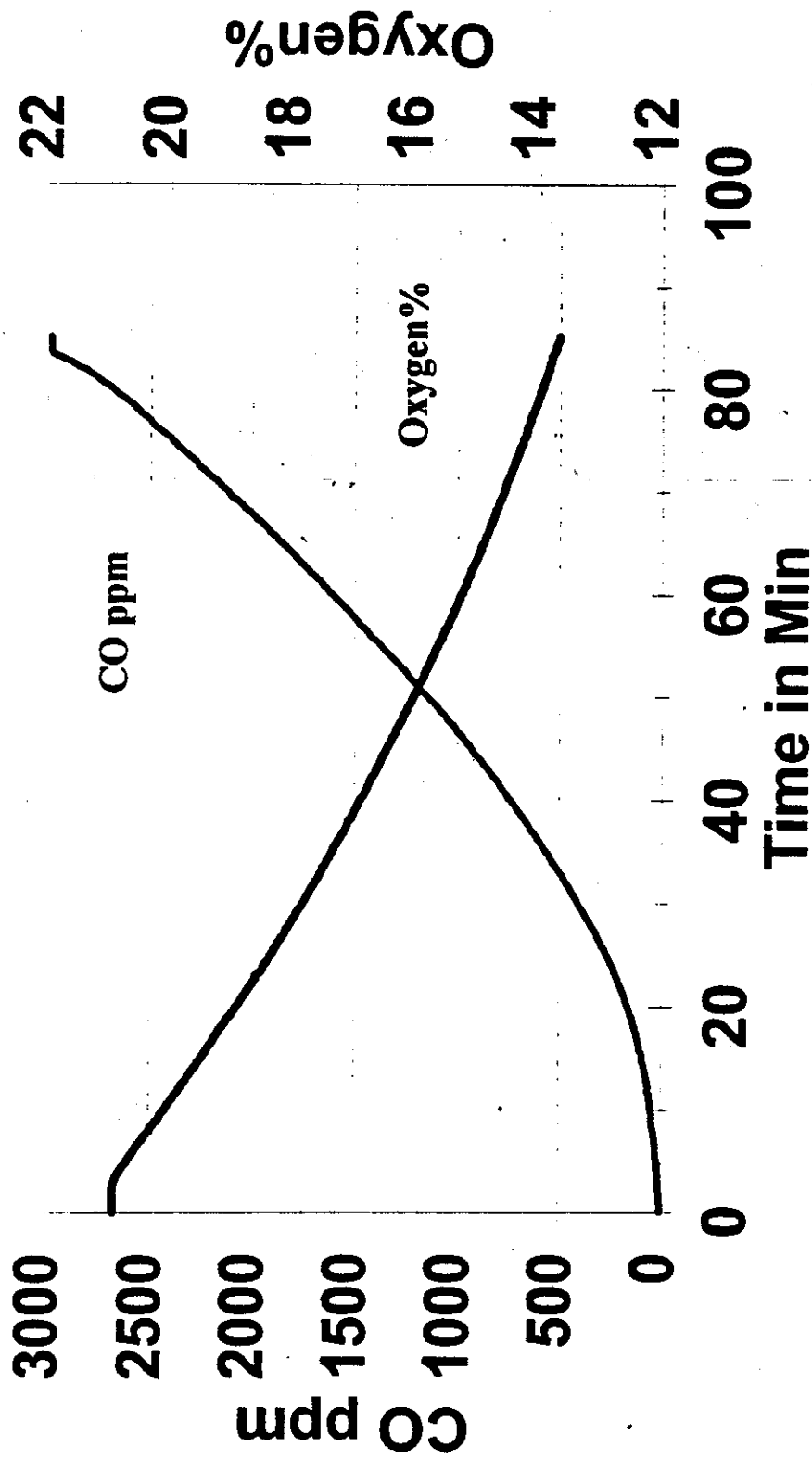
— CO ppm — % Oxygen

5 - 8,000 BTU; 0 ACH



— CO ppm — Oxygen%

5 - 8,000 BTU; 0.45 ACH

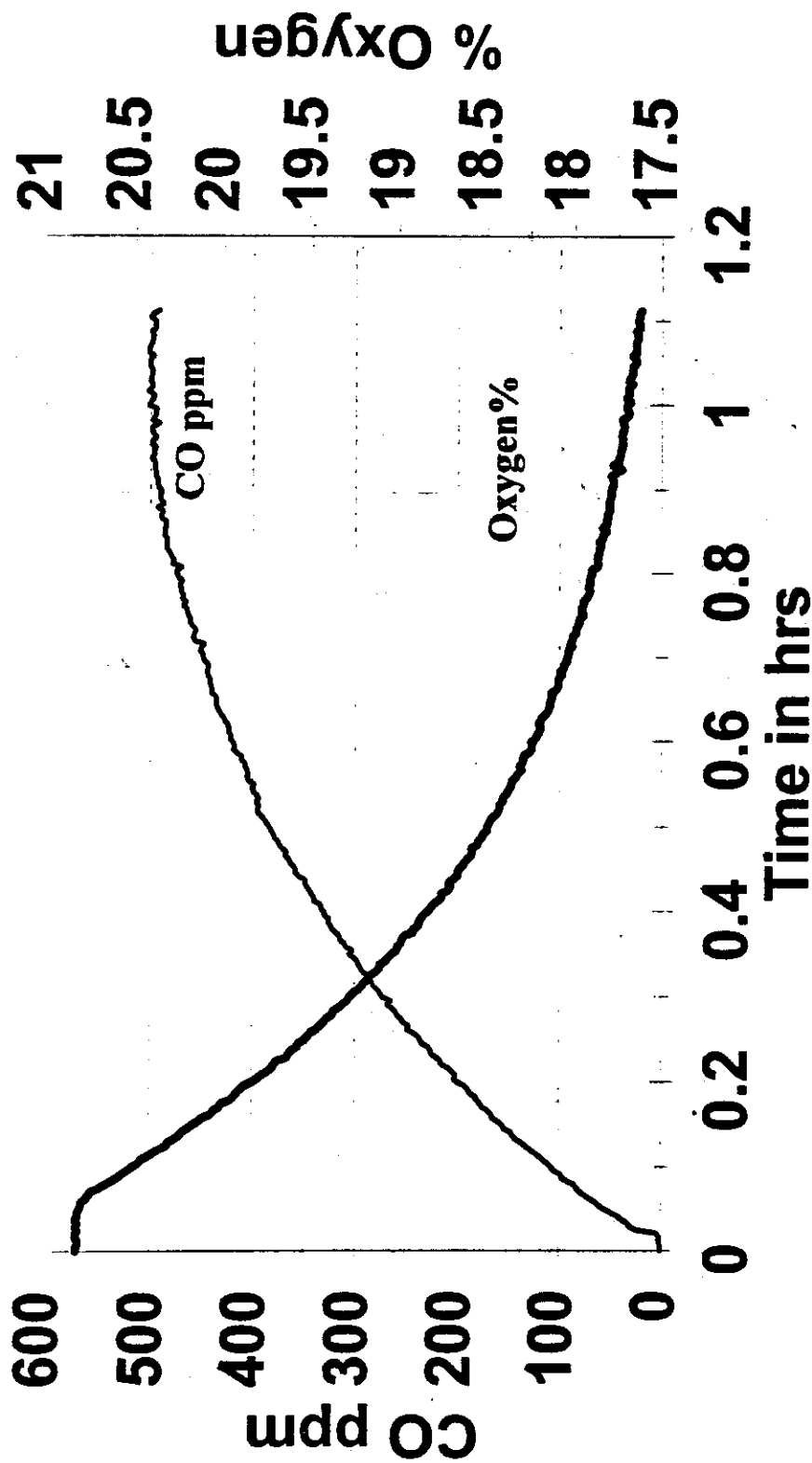


— CO ppm — Oxygen %

Testing

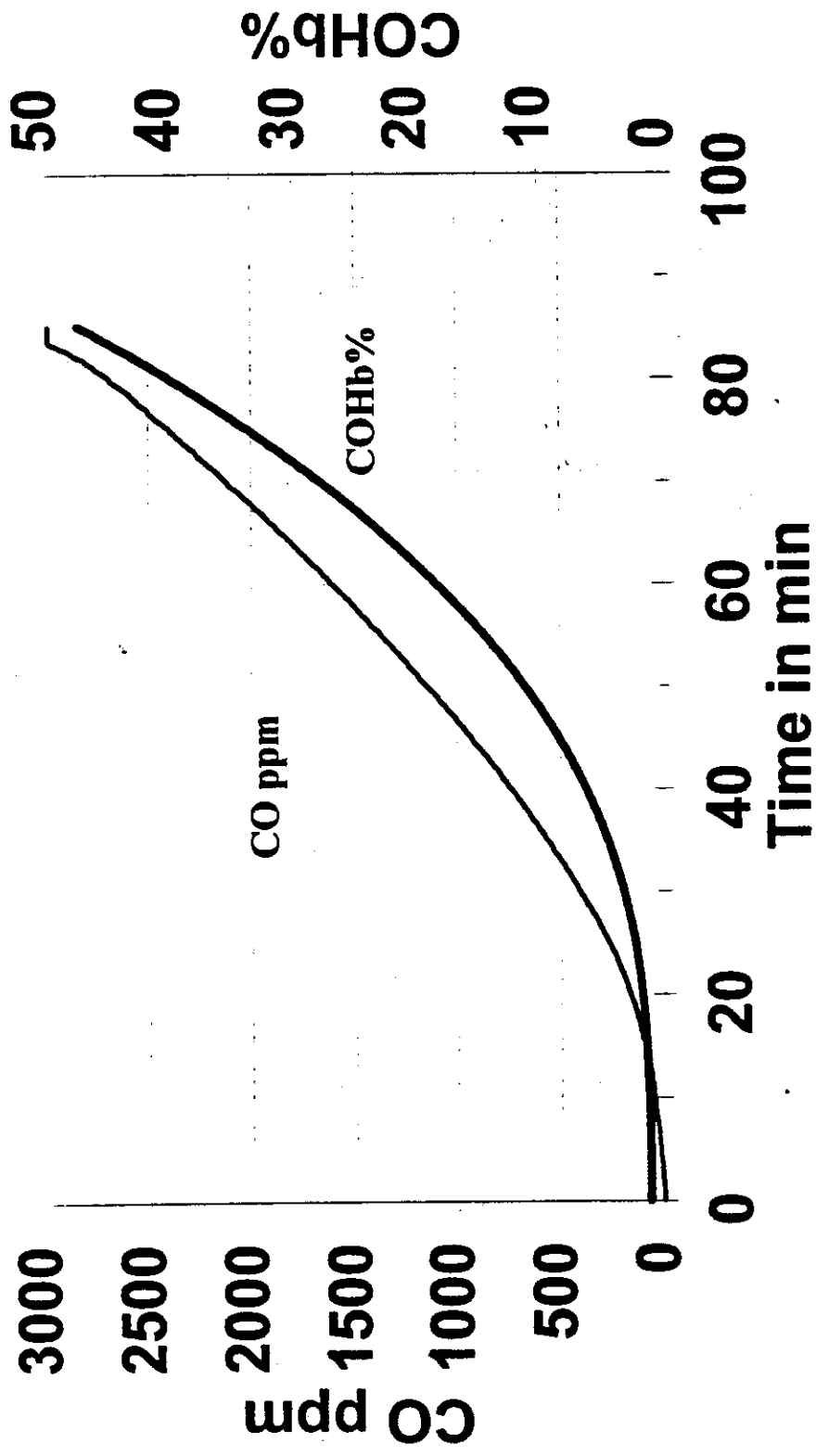
- Heaters from all manufacturers
- 0 ACH Testing for comparison to standard
- Test at 0.5, 1.0, 1.5 and 2 ACH

5 - 8,000 BTU; 1.85 ACH



— CO ppm — O₂ %

5 - 8,000 BTU; 0.45 ACH



— CO ppm — COHb%

Ave chamber perssure = 29.39 in Hg
Ambient pressure = 29.4 in Hg

CO vs Oxygen

